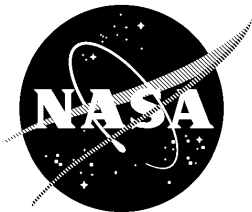


NETWORKS AND MISSION SERVICES PROJECT

WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) Service Specification

Revision 1

December 1998



National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

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1.0 Introduction

1.1 Purpose and Scope

The White Sands Complex (WSC) Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) supports customers who require TCP/IP access to the WSC for telemetry and command processing. Support is provided from the NASA Integrated Services Network (NISN) Closed IP Operational Network (IONET), using a defined set of authorized addresses. Support provided by the first version of the WDISC is approved for three initial customers, New Millennium Program Earth Orbiter-1 (NMP/EO-1), Gravity Probe B (GP-B), and Far Ultraviolet Spectroscopy Explorer (FUSE). However, a fourth customer, Microwave Anisotropy Probe (MAP), will also be using WDISC services.

1.2 Context

The WDISC

- affords TCP/IP customers uniform access to Space Network (SN) services provided by the White Sands Complex (WSC) ground stations using local interfaces (LIs).
- uses a Programmable Telemetry Processor (PTP)—a commercial off-the-shelf (COTS) product—to provide the required capabilities.
- is scheduled and configured by the Network Control Center (NCC).
- is compatible with the Consultative Committee for Space Data Systems (CCSDS) Telemetry and Telecommand services.

1.3 Overview

This document specifies the services provided by the WDISC. Section 2 defines the customer interfaces with the WDISC. Section 3 describes the principal operations of the WDISC. Appendix A provides details of the TCP/IP (external) interfaces and serial (internal) interfaces at WSC.

1.4 References

The latest version of the following documents is applicable.

- a. *WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) Project Management Plan (PMP)*, 451-WDISC-PMP 98.
- b. *WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) System Requirements*, 451-WDISC-SRD 98.
- c. *WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) Operations Concept*, 451-WDISC-OCD 98.
- d. *Interface Control Document (ICD) Between the Network Control Center (NCC) and the Mission Operations Centers*, 530-ICD-NCCDS/MOC.

- e. *Space Network (SN) User's Guide*, 530-SNUG.
- f. *Interface Control Document (ICD) Between the Network Control Center (NCC)/Flight Dynamics Facility (FDF) and the White Sands Complex (WSC)*, 530-ICD-NCC-FDF/WSC.
- g. *Internet Protocol: DARPA Internet Program Protocol Specification*, RFC 791.
- h. *Internet Control Message Protocol*, RFC 792.
- i. *Transmission Control Protocol*, RFC 793.
- j. *File Transfer Protocol*, RFC 959.
- k. *Packet Telemetry*. Recommendation for Space Data Systems Standards. CCSDS 102.0-B-3. Blue Book. Issue 3. Washington, DC: CCSDS, November 1992.
- l. *Telemetry Channel Coding*. Recommendation for Space Data Systems Standards. CCSDS 101.0-B-3. Blue Book. Issue 3. Washington, DC: CCSDS, May 1992.
- m. *Packet Telemetry Services*. Draft Recommendation for Space Data Systems Standards. CCSDS 103.0-B-1. Blue Book. Issue 1. Washington, DC: CCSDS, May 1996.
- n. *Advanced Orbiting Systems, Networks and Data Links: Architectural Specification*. Recommendation for Space Data Systems Standards. CCSDS 701.0-B-2. Blue Book. Issue 2. Washington, DC: CCSDS, November 1992.
- o. *Telecommand Part 1 — Channel Service*. Recommendation for Space Data Systems Standards. CCSDS 201.0-B-1. Blue Book. Issue 1. Washington, DC: CCSDS, January 1987.
- p. *Telecommand Part 2 — Data Routing Service*. Recommendation for Space Data Systems Standards. CCSDS 202.0-B-2. Blue Book. Issue 2. Washington, DC: CCSDS, November 1992.
- q. *Telecommand Part 3 — Data Management Service*. Recommendation for Space Data Systems Standards. CCSDS 203.0-B-1. Blue Book. Issue 1. Washington, DC: CCSDS, January 1987.

2.0 Interfaces

2.1 Transport-Level Interfaces

Customer access to the WDISC is via TCP/IP connection for forward and return services. For forward services, the customer sends data via TCP/IP to the PTP at WSC. The PTP then sends that data to the WSC Local Interface (LI) via one of three PTP boards. The particular LI port to be used is identified by User Interface Channel ID (UIFC). For return data, the PTP receives the data from the WSC LI via one of three PTP boards. It

frame-syncs to the data and performs processing on it if necessary. The data is then shipped to the customer via a TCP/IP connection. Mission-specific port numbers are assigned to each customer, as required, for control and data ports for forward services, and for data port(s) for return services.

TCP/IP client/server relationships are established on a customer-by-customer basis. The preferred configuration of the PTP is as a TCP/IP server, with the MOC initiating the connection. However, the PTP may be configured as a TCP/IP client, so that the PTP initiates the connection at the time that support is scheduled to begin. [In the latter configuration, the customer \(server\) side is expected to accommodate receiving data from both PTPs \(prime and backup\) simultaneously.](#)

Interfaces with the customer Mission Operations Center (MOC) are summarized in Table 2-1. Each service is identified by UIFC which appears in the User Schedule Message (USM) from the NCC. The corresponding domain names are listed. The two domain name entries correspond to the primary and redundant PTP hosts.

NOTE

Details of the IP address assignments and internal configuration of the PTPs are provided in Appendix A.

Table 2-1 MOC Interfaces with WDISC

Service	User Interface Channel	Domain Name XXX.ops.nascom.nasa.gov
Forward-1	W30	XXX=scptp1 or scptp2
Return-1	W55	XXX=scptp1 or scptp2
Control-1	–	XXX=scptp1 or scptp2
Forward-2	W31	XXX=scptp1 or scptp2
Return-2	W56	XXX=scptp1 or scptp2
Control-2	–	XXX=scptp1 or scptp2
Forward-3	W32	XXX=scptp1 or scptp2
Return-3	W57	XXX=scptp1 or scptp2
Control-3	–	XXX=scptp1 or scptp2
Forward-4	W40	XXX=wcptp1 or wcptp2
Return-4	W69	XXX=wcptp1 or wcptp2
Control-4	–	XXX=wcptp1 or wcptp2
Forward-5	W41	XXX=wcptp1 or wcptp2
Return-5	W79	XXX=wcptp1 or wcptp2
Control-5	–	XXX=wcptp1 or wcptp2
Forward-6	W42	XXX=wcptp1 or wcptp2
Return-6	W80	XXX=wcptp1 or wcptp2
Control-6	–	XXX=wcptp1 or wcptp2

2.2 Application-Level Interfaces

All application-level interfaces are carried over connections (socket interfaces) that are associated with a particular “desktop” (i.e., the configuration file that defines and controls all the capabilities of one PTP board). Since there are three boards per PTP, there will be three PTP servers (i.e., software processes) running on a single PTP. All application-level interactions are with *the specific PTP server* associated with that desktop. For each customer and service requirement, a unique desktop must be developed for each PTP board. Since each UIFC is associated with only one PTP board, the UIFC specified for a scheduled service in the USM provided by the NCC is sufficient to identify the correct desktop, and therefore, PTP board, to access. However, mission-specific port assignments assure that the correct board is accessed without additional MOC actions. (See References d and e for more information on MOC interactions with the NCC.)

The WDISC PTPs are compatible with particular CCSDS data formats for space link communications. Among the Ground Transport Headers they support are IP data unit (IPDU), standard formatted data unit (SFDU), low earth orbit-terminal (LEO-T), and others. Playback data is available via File Transfer Protocol (FTP) servers in the WDISC PTPs. Control character strings for the forward data switching are simply American Standard Code for Information Interchange (ASCII) text.

The application-level protocols (layered above TCP/IP) are summarized in Table 2–2.

Table 2-2a Application Level Protocols for Data

Interface Type	“Space Link Format”	“Ground Transport Header”	Reference	Content
Return Data	CCSDS	IPDU	k–m	Return telemetry with status header
Return Data	CCSDS	SFDU	k–m	Return telemetry with SFDU header
Return Data	CCSDS	LEO-T	k–m	Return telemetry with LEO-T header
Forward Data	CCSDS	IPDU	o–q	Command data

Table 2-2b Application Level Protocols for Control and Status

Interface Type	“Space Link Format”	“Ground Transport Header”	Reference	Content
Control-forward data switch	N/A	ASCII	N/A	Control character string
Status-forward data processing	N/A	ASCII	N/A	System Heartbeat

NOTE

ASCII character strings are transported over TCP/IP sockets.

Table 2-2c Application Level Protocols for Playback

Interface Type	“Space Link Format”	“Ground Transport Header”	Reference	Content
Playback Data	N/A	FTP	j	Files of recorded data

3.0 Operational Considerations

3.1 Nominal Operations

The WDISC configuration and nominal scenarios are discussed in Reference c. The MOC is responsible for

- Requesting SN service from the NCC (two to three weeks in advance). See Reference e for a description of this process.
- Receiving responses from the NCC (typically a USM) that indicates the SN resources (TDRS, antenna, UIFCs) allocated to this support.
- Connecting to the data ports of the appropriate PTPs (prime and backup) at the addresses shown in Table 2-1, using a mission-specific assigned data port number.
- (For forward services) sending a control character string to the control port of the prime PTP to set the forward data switch correctly, using the mission-specific assigned control port number.
- Receiving WDISC support throughout the scheduled support period.
- (For forward services) monitoring the system heartbeat on the control port throughout the scheduled support period.
- (At a later time if playback is required) downloading saved files via FTP from the PTP at the standard port numbers (20 and 21).

NOTE

Customers that access the WDISC via the Closed IONET may carry out the download autonomously. Security policy requires that customers who access the WDISC via the Open IONET contact the NCC PA and request a download. The NCC Operator will then download the requested files directly to the customer’s facility.

3.2 Failover Operations

The WDISC provides redundant PTPs to permit failovers with minimal lost support. The MOC is responsible for

- a. Monitoring the flow of return data and the presence of the forward service system heartbeat to identify when support is lost.
- b. Informing the NCC operator of the failure.
- c. Connecting to the data port of the backup PTP, using the mission-specific assigned data port number.
- d. (For forward services) requesting the NCC to send a control character string to reset the forward data switch to the backup position.
- e. Resuming support via the backup PTP.

Appendix A External and Internal WDISC Interfaces

A.1 TCP/IP Connectivity

A.1.1 IP Addresses

WDISC provides four PTPs that are accessible via the Closed IONET. IP addresses are obtained by resolving server aliases (i.e., domain names) to IP addresses. NISN operates a Domain Name System (DNS) server supporting PTP server aliases to permit a client's DNS Name Resolvers to perform this service. Table A-1 lists the aliases for each PTP located at STGT or WSGT.

Table A-1 IP Address Aliases

PTP Identifier	Domain Name
STGT-PTP1	scptp1.ops.nascom.nasa.gov
STGT-PTP2	scptp2.ops.nascom.nasa.gov
WSGT-PTP1	wcptp1.ops.nascom.nasa.gov
WSGT-PTP2	wcptp2.ops.nascom.nasa.gov

A.1.2 TCP Port Assignments

Each PTP has three identical boards. Each board has TCP/IP interfaces for forward and return data services, as well as for control and status. Mission-specific port assignments are used to access the correct board without further customer actions.

A.2 Serial Data Configuration

Prime and backup PTPs are located at each ground terminal. The serial interfaces of corresponding boards of the prime and backup PTPs are connected to specified LI ports. Each pair of return serial interfaces shares a specified return LI port. Each pair of forward serial interfaces is connected to its forward LI port via a forward data switch. Table A-2 describes the configuration of each board. The corresponding UIFCs are also indicated.

Table A-2 WDISC Internal Configuration

PTP Identifier	Board Identifier	Forward LI Port (UIFC)	Return LI Port (UIFC)
STGT-PTP1	Board 1	J (W30)	P (W55)
STGT-PTP1	Board 2	K (W31)	Q (W56)
STGT-PTP1	Board 3	L (W32)	R (W57)
STGT-PTP2	Board 1	J (W30)	P (W55)
STGT-PTP2	Board 2	K (W31)	Q (W56)
STGT-PTP2	Board 3	L (W32)	R (W57)
WSGT-PTP1	Board 1	J (W40)	P (W69)
WSGT-PTP1	Board 2	K (W41)	Q (W79)
WSGT-PTP1	Board 3	L (W42)	R (W80)
WSGT-PTP2	Board 1	J (W40)	P (W69)
WSGT-PTP2	Board 2	K (W41)	Q (W79)
WSGT-PTP2	Board 3	L (W42)	R (W80)

NOTE

LI port assignments use the designations found in Reference f.

Abbreviations and Acronyms

ASCII	American Standard Code for Information Interchange
CCSDS	Consultative Committee for Space Data Systems
COTS	commercial off-the-shelf
DNS	Domain Name System
EO-1	Earth Orbiter-1
FTP	File Transfer Protocol
FUSE	Far Ultraviolet Spectroscopy Explorer
GP-B	Gravity Probe B
ID	identifier
IONET	IP Operational Network
IP	Internet Protocol
IPDU	IP data unit
LEO-T	low earth orbit-terminal
LI	local interface
MAP	Microwave Anisotropy Probe
MOC	Mission Operations Center
NASA	National Aeronautics and Space Administration
NCC	Network Control Center
NISN	NASA Integrated Services Network
NMP	New Millennium Program
PTP	Programmable Telemetry Processor
SFDU	standard formatted data unit
SN	Space Network
STGT	Second TDRSS Ground Terminal
TCP	Transmission Control Protocol
TDRS	Tracking and Relay Satellite
TDRSS	Tracking and Relay Satellite System
UIFC	user interface channel ID
USM	user schedule message
WDISC	WSC TCP/IP Data Interface Service Capability
WSC	White Sands Complex
WSGT	White Sands Ground Terminal